

IN THE SPECIFICATION

Please amend the paragraphs of the specification as follows:

On page 1, please replace paragraph [1001] with the following amended paragraph:

With the proliferation of Internet-capable devices, both wireless and wireline devices, the number of addresses available for routing IP (Internet Protocol) transmissions is being depleted. As a result, in some regions users are no longer assigned a static IP address, but rather are dynamically assigned an IP address to accommodate the many users within a given system. The total number of IP addresses available is a function of the number of bits per address. One method for increasing the number of addresses is to increase the size of the IP address. Larger IP addresses, however, increase the loading and processing complexity of a system[[:]] and[[:]] increasing the address size requires a total upgrade of the entire IP network (Internet), incurring significant costs.

On page 1, please replace paragraph [1003] with the following amended paragraph:

FIG. 1A is a diagram of a Network Address Translator (NAT) in an Internet Protocol (IP) communication system.

On page 2, please replace paragraph [1012] with the following amended paragraph:

With the proliferation of wireless Internet devices, there is a clear shortage in the number of globally routable IPv4 addresses. In countries outside of the US, namely Asia and Europe, the pool of global IPv4 addresses is almost depleted. Because of this, users often are not assigned static IP addresses and may not always be directly reached via IP protocols from the Internet. Network Address Translators (NATs) have been introduced as a means of expanding the number of IPv4 addresses in a private network; however, NATs assign private IP addresses that cannot be reached from outside the private network (i.e., they are not globally routable).

On page 2, please replace paragraph [1013] with the following amended paragraph:

According to the exemplary embodiment, local users are assigned a global Network Access Identifier (NAI). The NAI is used as an individual address (e.g., jsmith@company.com) instead of an IPv4 address. A gateway is then used to ~~converts~~ convert a user's NAI into a local, private IP address via a translation mapping provided by the NAT. The private IP address may be used by the private network to forward the packets to the user. The exemplary embodiment may be implemented in a wireless network and applied to mobile stations without modification to a given communication standard.

On page 3, please replace paragraph [1014] with the following amended paragraph:

As discussed hereinabove, one method for increasing available IP sessions without increasing the number of IP addresses incorporates a Network Address Translator (NAT) as an interface between a regional communication system and a local communication system. Typically in a local communication system, only a small percentage of hosts communicate outside of the local system or domain at any given time. The local domain, such as a corporate network, only handles traffic originated or destined to hosts in the domain. Many of these hosts never communicate outside of the local domain. Therefore, only a subset of the IP addresses inside a local domain need to be translated into IP addresses that are globally unique for regional communication. The NAT provides a translation to and from the local network and thus replaces the end-to-end significance of an IP address with a mapping of a global IP address to a local address. The benefit of the NAT is the increased capacity in the network.

On page 5, please replace paragraph [1020] with the following amended paragraph:

FIG. 2 illustrates a communication system 200 supporting IP communications. A gateway 204, such as a PUSH gateway, is coupled to a packet source, such as the Internet 202. Information is sent from the Internet 202 to gateway 204 in packets. Each packet includes payload information and NAI information corresponding to the target recipient. Each packet also has an associated IP header to assist the Internet to deliver the packet initially to the gateway (i.e., the packet with the NAI has the gateway IP address as ~~[[the]]~~ its destination IP address). The format of the packets as they traverse the system 200 are illustrated by way of datagram overlays

to the system 200 diagram. As described hereinabove, the NAI provides a common, unique address identifier for the target recipient. The NAI is intended to uniquely identify the target recipient, which in a mobile IP situation is typically a mobile user, i.e., mobile node. The gateway 204 receives the packet and extracts the NAI information. The gateway 204 then redirects the packet within the system. The gateway 204 effectively converts the NAI into a local, private IP address via a translation mapping, wherein the translation mapping was assigned by the destination NAT and provided by a registration message prior to the communication. The gateway 204 communicates with other resources within system 200 using a Session Initiation Protocol (SIP) discussed hereinbelow. Note that at this point, the packet may or may not include the NAI information. Since the NAT IP address and the port number corresponding to the user are already included in the packet, the user will receive the packet.

On page 5, please replace paragraph [1022] with the following amended paragraph:

In a communication system having an interface with an Internet Protocol (IP) type network, specific signaling protocols are commonly used to address initiation, termination, and other issues involved in a communication. One such protocol is the Session Initiation Protocol or SIP. SIP is a signaling protocol used for Internet conferencing, telephony, presence, events notification and instant messaging, as well as many other Internet applications. SIP was developed within the IETF MMUSIC (Multiparty Multimedia Session Control) working group, with work proceeding since September 1999 in the IETF SIP working group[[:]]. SIP is described in RFC 2543 entitled "SIP: Session Initiation Protocol," which is hereby expressly incorporated by reference.

On page 6, please replace paragraph [1024] with the following amended paragraph:

SIP may be used to establish, modify and terminate multimedia sessions or calls. Multimedia sessions may include multimedia conferences, distance learning, Internet telephony and similar applications. SIP may be used to invite both persons and devices, such as a media storage service, etc., to both unicast and multicast sessions, wherein the initiator may send invitations to a session to which it is not a part of. SIP may be used to initiate sessions as well as invite members to sessions that have been advertised and established by other means. Sessions

may be advertised using multicast protocols such as Session Announcement Protocol (SAP), electronic mail, news groups, web pages or directories, among others. The SIP transparently supports name mapping and redirection services, allowing the implementation of Integrated Services Digital Network (ISDN) and Intelligent Network telephony subscriber services. These facilities also enable personal mobility. In the parlance of telecommunications intelligent network services, personal mobility is the ability of end users to originate and receive calls and access subscribed telecommunication services on any terminal in any location, and the ability of the network to identify end users as they move. Personal mobility is based on the use of a unique personal identity (i.e., personal number).

On page 6, please replace paragraph [1025] with the following amended paragraph:

Initially, when a Mobile Station (MS) or other mobile device (not shown) is assigned a private/local IP address in a NAT zone, the MS registers with a gateway using SIP registration procedures. The gateway 204 may be a "PUSH" gateway. The term PUSH implies that the gateway allows applications on the Internet to push traffic to the user, without requiring the user to make a request for the information. Similarly, a user request for information from the Internet is referred to as a "PULL." The registration message from the MS passes through the NAT to the IP network 206, wherein the payload includes the registration message; the message sent from the MS is a SIP registration message. The SIP registration message includes NAI specific to the MS. The packet is forwarded from the IP network 206 to the PUSH gateway 204. The same SIP registration message is included, however, the source IP address and port is changed by the NAT. The PUSH gateway 204 extracts the NAI information from the packet and records the NAI. The gateway 204 also extracts and records the translated source address and port number of the message (i.e., IP address of NAT and the translated port number for the user's private IP address). Note that the translated IP source address and port number are in the TCP or UDP header. The PUSH gateway 204 generates and maintains a mapping of NAI to NAT IP address and port number. In this way, on receipt of an incoming message from the Internet that contains the NAI of the MS, the gateway 204 is able to direct messages to the NAI associated with the target recipient. The PUSH gateway 104 translates the destination IP address and port number corresponding to the NAI information. The packet is then forwarded to the appropriate NAT via

standard IP routing procedures. Upon receipt of the packet, the NAT performs standard network address translation to direct the packet to a private IP address associated with the MS. When the message is received at the ~~mobile station~~ MS, the MS may use this message to start a session, including a PULL-type of session such as HTTP, SMTP, FTP, etc., responsive to the message content.

On page 7, please replace paragraph [1026] with the following amended paragraph:

For wireless mobility, the MS re-registers with the PUSH gateway 204 whenever it roams into a different NAT zone. In each zone, the MS is assigned a private IP address, which will be translated into a distinct NAT IP address and port number when the MS registers with the PUSH gateway 204. When the PUSH gateway 204 receives a new registration for ~~[[a]]~~ an MS having an active NAI mapping, i.e., MS already has an existing record of a mapping between the NAI and a NAT address & port number, the PUSH gateway 204 replaces the existing mapping with the new NAT address and port number specified in the new registration.

On page 8, please replace paragraph [1027] with the following amended paragraph:

FIG. 3 illustrates the configuration of a wireless communication system 300, wherein a NAT zone, NAT A 320 is coupled to an IP cloud 322. The IP cloud 322 is then coupled to various local networks through Packet Data Service Node(s) (PDSNs). Two PDSNs are illustrated as an example, ~~PDSN 324~~ PDSN 324 and PDSN 326. Note that both PDSN 324 and PDSN 326 are each coupled to DHCP server 328. The PDSN 324 serves MS 332, while the PDSN 326 serves MS 330. Initially, when an MS enters a PDSN service area, the MS registers. In the exemplary embodiment, MS 332~~[[,]]~~ and 330 register with the gateway 204. The registration is actually directed to the gateway~~[[,]]~~ but passes through the PDSN & NAT using an SIP registration process. The SIP registration includes a local IP address as the source of the communication and also includes an NAI. The SIP registration is sent through the PDSN, and from there the registration message is provided to NAT A 320 via the IP cloud 322. The NAT A 320 changes the source address of the SIP registration message to a global IP address associated with the NAT A 320, plus a port number corresponding to the sending MS. Note that the PDSNs are not disjoint, and they share the same private IP address space.

On page 8, please replace paragraph [1029] with the following amended paragraph:

FIG. 5 illustrates a method 500 for processing packets in an IP communication system 400 of FIG. 4. At step 502, when the MS 412 has been assigned a private IP address by the local PDSN 410, the MS creates an SIP registration request and sends the registration request to the gateway 404, through the local PDSN 410. The registration request identifies the source address and the NAI of MS 412. The PDSN simply forwards the SIP message on through the NAT A (step 504). NAT A does the translation, and forwards the message onto the gateway (step 506). The gateway 404 then extracts and records the source address and port number of the SIP registration at step 508. Since the SIP registration message from the MS is meant to register the MS with the gateway, the SIP registration message terminates at the gateway.

On page 9, please replace paragraph [1030] with the following amended paragraph:

After registration is complete, the system is prepared to deliver PUSH traffic to the MS. When the CS sends packets to the MS₂, it directs the packets to the gateway 404 and includes the MS specific NAI. At step 512, the system processes these incoming packets based on the NAI and the MS local NAT mapping. The gateway 404 uses the MS NAI to direct the packets to the corresponding NAT address and port number of the MS. Within NAT A 406 the local routing to MS 412 is performed. The NAT A 406 uses the port number to identify the MS 412 among all the users supported in the zone.

On page 9, please replace paragraph [1031] with the following amended paragraph:

FIG. 6 illustrates a timing scenario associated with the processing of packets in a communication system. The vertical axis represents time, while the horizontal axis identifies elements and components of the system. At time t₁, the packet is sent from an IP source, such as the Internet, to the gateway. The packet is addressed to the gateway and includes the NAI of the target recipient. At time t₂, the gateway changes the destination address and port number based on the NAI information. The packet is then forwarded to the NAT zone, NAT_A. At time t₃, the NAT_A changes the destination address based on the destination port number and forwards the packet to the PDSN. The PDSN then delivers the packet to the target recipient at time t₄.

On page 9, please replace paragraph [1032] with the following amended paragraph:

The MS may also initiate a packet transfer, as ~~illustrates~~ illustrated from time t5, wherein the MS client desires to retrieve data from the Internet, or other IP packet source. The MS client sends a request through NAT_A, wherein the MS client is identified as the source. The NAT_A translates the source address into the NAT_A IP address and the port number assigned to the MS by the NAT_A at time t6. The packet is then sent from the Internet, or other IP packet source, at time t7. On receiving the requested packet, the NAT_A changes the destination IP address, i.e., NAT IP address, based on the destination port number at time t8 and delivers the packet to the MS.

On page 10 please replace paragraph [1034] with the following amended paragraph:

As described with respect to the embodiments detailed hereinabove, when ~~[[a]]~~ an MS is assigned a local network IP address, i.e., a private IP address, the MS registers with a gateway. The local network is part of a NAT zone, wherein within the local network each user is identified by a private IP address. Outside the local network, all users in the local network are identified by the IP address of the NAT and the corresponding port numbers. Each MS registers with a gateway using SIP registration procedures. The registration request includes the NAI of the MS. The registration message passes through the NAT (of the zone) and is forwarded to the gateway, typically via an IP cloud. The gateway records the NAI included in SIP registration message and the translated source address and port number of the registration message source. The gateway thus records the NAT IP address, and the port number of the user's private IP address. The gateway maintains the mapping of NAI to NAT IP address and port number. Upon receipt of SIP messages from the Internet addressed to an NAI, the gateway translates the destination IP address and port number accordingly.

On page 10, please replace paragraph [1035] with the following amended paragraph:

The gateway records the mapping of the users NAI to the NAT IP address and port number. The use of the NAI increases the available identifiers, as the NAI is globally unique and has significant more combinations for use than those defined in ~~[[IPv4]]~~ IPv4.

On page 10, please replace paragraph [1036] with the following amended paragraph:

FIG. 8 illustrates a portion of a gateway, such as gateway 204 of FIG. 2 for processing IP packets received from the Internet. Each time an MS moves to a new NAT zone, the MS sends an SIP registration to the ~~NAI, IP~~ NAI, NAT address and port number processing unit 908, which extracts the NAI information, ~~[[IP]]~~ NAT address and port number information and stores this information as a connected pair in the translation map 904. The translation map 904 may be as illustrated in FIG. 7. The translation map 904 includes multiple mappings of potential target recipients.

On page 11, please replace paragraph [1037] with the following amended paragraph:

Continuing with FIG. 8, IP packets are received and processed in IP processing unit 906, wherein the payload information and the destination information are received. The destination information is extracted from the IP packet to determine the NAI of the target recipient. The NAI information is provided to the translation map 904~~[[,]]~~ to determine the NAT address and port number associated with the target recipient, as identified by the NAI.

On page 10, please replace paragraph [1036] with the following amended paragraph:

The steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM (read access memory) memory, flash memory, ROM (read only memory) memory, EPROM (erasable programmable electrical memory) memory, EEPROM (electrical erasable programmable memory) memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.